1874MNRAS..34..370B

Notes in reply to Sir John Herschel's "Queries relative to Double Stars." By S. W. Burnham, Esq.

The following Queries as left by the late Sir John Herschel were printed in the *Monthly Notices* for November 1871, by the Committee appointed by the Royal Astronomical Society, to examine and report upon a collection of papers bequeathed by him to the Society for the preparation of a "General History of Double Stars," with the request that observers should aid in removing the doubts existing in reference to these stars. As stated in the recent Report of the Council, one of the forthcoming volumes of *Memoirs* will contain this very valuable and needed contribution. I was not aware until within a few months of these Notes of Herschel; but some time previously prepared a list of several hundred double stars requiring telescopic examination, and which included most of the following objects. The list might be very much extended. I select from a large mass of notes such as pertain to the double stars in question. The observations have been made exclusively with a 6-in. Clark refractor.

$$h\ 2021 \left\{\begin{array}{lrrr} & \text{h} & \text{m} & \text{s} \\ \text{R.A.} = & 1 & 0 & 37 \\ & {}^\circ & ' & '' \\ \text{P.D.} = & 109 & 31 & 40 \end{array}\right\} \text{Is it really close double?—“Violent suspicion.}$$

Examined on only occasion only, but no double star found in this place. The night, however, was not first class, and if a *very* difficult object, it might not have been seen.

$$\Sigma\ 168 \left\{\begin{array}{lrrr} & \text{h} & \text{m} & \text{s} \\ \text{R.A.} = & 1 & 40 & 17 \\ & {}^\circ & ' & '' \\ \text{P.D.} = & 20 & 47 & 30 \end{array}\right\} \text{Not seen double by } h.$$

I have just noticed for the first time, that the above P.D. as given by Herschel is incorrect. It should be, 24° 7′ 31″. I have looked for this pair several times, but I think on each occasion used Herschel's P.D., and of course failed to find it. Herschel's observation occurs in his Fourth Catalogue, and there the place is correctly stated, so that it was properly searched for by him. It is now too low to do anything with.

$$\Sigma\ 211 \left\{\begin{array}{lrrr} & \text{h} & \text{m} & \text{s} \\ \text{R.A.} = & 1 & 55 & 54 \\ & {}^\circ & ' & '' \\ \text{P.D.} = & 96 & 14 & 50 \end{array}\right\} \text{No such star found in or near place by } h.$$

I could not find any star as bright as 8th mag. in this place: there are some small stars, but none of them were seen double. This is one of Struve's rejected pairs, and is not included in *Positiones Mediæ*, or *Mensuræ Micrometricæ*. It is given in Struve's early Catalogue as Class IV., and magnitudes (8), (10).

1874MNRAS..34..370B

$$\left.\begin{array}{l}\Sigma\,343\begin{cases}\text{R.A.} = 2^{\text{h}}\ 55^{\text{m}}\ 23^{\text{s}}\\ \text{P.D.} = 6^{\circ}\ 35'\ 32''\end{cases}\\ \Sigma\,347\begin{cases}\text{R.A.} = 2^{\text{h}}\ 56^{\text{m}}\ 27^{\text{s}}\\ \text{P.D.} = 6^{\circ}\ 35'\ 2''\end{cases}\end{array}\right\}$$

Are these the same double star? Σ is confused, and *h* disagrees.

In *Mensuræ Micrometricæ* it is stated that the two are identical, there being an error of 1^{m} in the R.A. of the second. Dembowski's measures of this pair show a slight change in the distance of the components, the angle remaining the same. Struve found, P = 325°·4; D = 22″·66, (1832·6). Dembowski gives, P = 325°·2; D = 24″·95 (1865·0). I am not acquainted with any other measures.

$$\Sigma\,407\begin{cases}\text{R.A.} = 3^{\text{h}}\ 21^{\text{m}}\ 56^{\text{s}}\\ \text{P.D.} = 101^{\circ}\ 43'\ 4''\end{cases}$$

Is the minute of R.A. 19 or 21? Σ.'s two catalogues differ.

The place of this pair appears to be the same ($3^{\text{h}}\ 21^{\text{m}}{\cdot}8$) in both Struve's Catalogues. It is not in *Positiones Mediæ*. I found it, readily identified it as L 6490, the place of which for 1830 is:

$$\text{R.A.} = 3^{\text{h}}\ 21^{\text{m}}\ 52^{\text{s}} \qquad \text{N.P.D.} = 101^{\circ}\ 43'\ 40''$$

$$\left.\begin{array}{l}\Sigma\,417\\ \Sigma\,518\end{array}\begin{cases}\text{R.A.} = \begin{cases}4^{\text{h}}\ 7^{\text{m}}\ 27^{\text{s}}\\ 4\ \ 7\ \ 48\end{cases}\\ \text{P.D.} = \begin{cases}97^{\circ}\ 55''\ 22'\\ 97\ \ 54\ \ 23\end{cases}\end{cases}\right\}$$

40 *Eridani*. Confusion exists. Wanted an exact diagram, description, and measures of A, B, C; and ? of a fourth star D.

Struve's place for 1830 (*Pos. Med.*) is:

$$\text{R.A.} = 4^{\text{h}}\ 7^{\text{m}}\ 27^{\text{s}} \qquad \text{P.D.} = 97^{\circ}\ 55'\ 22''$$

This agrees exactly with the British Association Catalogue. There are four companions, the measures of which are as follow:—

	Pos. °	Dist. ″	Mags.	
A and B	107·2	83·48	4, 9·1	Struve (1836·0)
B " C	159·9	3·±	10½, 11	Dawes (1851)
A " D	185·0	75·85	...	Winnecke (1864·8)
A " E	312·5	89·45	...	Winnecke (1864·8)

Engelmann for A and B (1863·1) gives 105°·4 : 82″·83. The close pair, constituting a binary system in rapid orbital motion, was found by Winnecke (1864·8) to give P = 147°·6; D = 4″·45.

1874MNRAS..34..370B

Knott (1871) estimates the angle and distance 125° ± : 2″ ±. My 6-inch refractor shows readily all these stars, except perhaps E, which was not particularly looked for. Struve speaks of a 12 mag. star at 16″·79 in the direction of 96°·8. I do not find any later or other mention of this star.

Σ 609	R.A. = $4^{h}\ 41^{m}\ 59^{s}$ P.D. = 89° 8′ 59″	? whether Struve's place, as here given from *Pos. Med.*, or that of my *Seventh Catalogue*, $4^{h}\ 43^{m}\ 4^{s}$, 89° 3′ 17″, be right. Positions and distances agree. Or are they really two different double stars? *My place* is corroborated in *Fifth Catalogue, h* 2240 *bis*, making the R.A. 43^{m}.

I examined this for the purpose of seeing if it was identical with *h* 686, given by Herschel without measures or magnitudes, with this note: "Close double; taken for Σ 609, but clouds prevented its description." I looked for it on a very superior night, but could not, or did not see it. Subsequently I found it very readily, and noted it as "very easy," estimating independently the distance at 2″, and the angle 80°. Struve gives D = 1″·93; P = 82°·1. There is something rather strange about this pair, unless by some oversight Dembowski missed it. He has this remark in his measures of double stars made in 1865·9: "Simple; bonnes conditions." He also found it single, 1866·1. Struve's mags. are 8·5, 8·7, which should make it, as I found it, an easy pair. Without ascertaining positively, it appears to be L 9101, the place of which agrees exactly with *Pos. Med.* I could not find any other pair in the neighbourhood, and have no doubt *h* 686 is the same as Struve's pair. Herschel's declination of that star agrees with Struve.

Σ 662	R.A. = $5^{h}\ 5^{m}\ 39^{s}$ P.D. = 94° 15′ 54″ P.D. = 64 15 54	In *Pos. Med.* the P.D. is 94° 15′ 54″, but in the *Dorpat Catalogue*, and also in the *Mens. Mic.*, the degree of P.D. is 64°. The declinations given are: *Dorpat*, +25° 45′; *Mens. Mic.*, +25° 45′; *Pos. Med.*, −4° 15′ 54″.

The place in *Mens. Mic.* is correct. The companion, although rated by Struve as 11th magnitude of his scale, was well seen with a power of 400, and is one of those minute stars which are improved by magnifying. There is no double in the place set down in *Pos. Med.* The star in question is L 9809.

h 5465	R.A. = $5^{h}\ 39^{m}\ 18^{s}$ P.D. = 78° 4′ 3″	An excessively minute *comes* 12″ distant suspected. ? if verified.

I have looked for this several times, once when the conditions were remarkably favourable, but have never been able to see the least trace of a companion. If it exists at all, which is very doubtful, it must be an object of excessive difficulty.

1874MNRAS..34..370B

$$\Sigma\ 923 \left\{ \begin{array}{l} \text{R.A.} = \left\{ \begin{array}{rrr} \text{h} & \text{m} & \text{s} \\ 6 & 22 & 18 \\ 6 & 42 & 15 \end{array} \right. \\ \text{P.D.} = \begin{array}{rrr} {}^\circ & ' & '' \\ 30 & 25 & 8 \end{array} \end{array} \right\}$$

? which is the right minute of R.A. Σ leaves it doubtful, and I have no observation of it.

This is one of Struve's rejected pairs, described in *Catalogus Novus* as Class IV. (6), (10). The correct minute of R.A. is 21. I am not aware of any measures having ever been made of this pair. The companion is too distant to make it a very interesting object, and for this reason it was not included in *Mens. Mic.* The companion is in the direction of about 140°. There is a more distant companion *s* a little *p*.

$$\Sigma\,1006 \left\{ \begin{array}{l} \text{R.A.} = \begin{array}{rrr} \text{h} & \text{m} & \text{s} \\ 6 & 51 & 22 \end{array} \\ \text{P.D.} = \left\{ \begin{array}{rrr} {}^\circ & ' & '' \\ 26 & 59 & 18 \\ 27 & 10 & 18 \end{array} \right. \end{array} \right\}$$

Which is the right P.D.? In the *Dorpat Catalogue* the declination is + 63° 1′; in the *Mens. Mic.*, + 62° 50′. Which is right?

This is a very wide pair (30″·59) of moderately bright stars, both of which are given in Argelander's *Zones* = *Arg.* (+ 62°) 902, 904. The place for 1855 of the principal star is:

$$\text{R.A.} = 6^{\text{h}}\ 53^{\text{m}}\ 27^{\text{s}} \qquad\qquad \text{P.D.} = 27^\circ\ 14'{\cdot}6$$

This does not agree exactly with either of Struve's Catalogues. I have not seen any measures of this pair made since Struve's observations.

$$\begin{array}{l} \Sigma'\ (989)\ g.\ c. \\ \sigma\ 295 \end{array} \left\{ \begin{array}{l} \text{R.A.} = \left\{ \begin{array}{rrr} \text{h} & \text{m} & \text{s} \\ 8 & 14 & 22 \\ 8 & 14 & 25 \end{array} \right. \\ \text{P.D.} = \left\{ \begin{array}{rrr} {}^\circ & ' & '' \\ 92 & 25 & 7 \\ 92 & 23 & 51 \end{array} \right. \end{array} \right\}$$

Set down as "very near" σ 295 (*Catalogi Prioris*). Are these really two different double stars? If not, which is right?

The first refers to the general number in *Positiones Mediæ.* There is but one pair in this place, and that is a very wide double, the companion nearly preceding, and about the 10th mag. The star is L 16441, and the place for 1830 from that Catalogue is:

$$\text{R.A.} = 8^{\text{h}}\ 14^{\text{m}}\ 21^{\text{s}} \qquad\qquad \text{P.D.} = 92^\circ\ 25'\ 0'',$$

agreeing with *Positiones Mediæ.* It is an uninteresting object, and so far as I am aware, has never been measured or included in any modern catalogue. I have carefully examined all the stars in the vicinity, and fail to find any other pair nearer than Σ 1233.

$$\Sigma\ 1259 \left\{ \begin{array}{l} \text{R.A.} = \begin{array}{rrr} \text{h} & \text{m} & \text{s} \\ 8 & 32 & 7 \end{array} \\ \text{P.D.} = \begin{array}{rrr} {}^\circ & ' & '' \\ 51 & 5 & 29 \end{array} \end{array} \right\}$$

In *Dorpat Catalogue* $8^{\text{h}}\ 31^{\text{m}}{\cdot}9$, decl. + 38° 56′ in *Mens. Mic.* $8^{\text{h}}\ 36^{\text{m}}$, decl. + 39° 5′. Query, Which is right? *h* has no observation.

1874MNRAS..34..370B

The place given is from *Positiones Mediæ*, which differs from Struve's other Catalogues both in R.A. and P.D.; and strangely enough they are all in error, but that from *Mensuræ Micrometricæ* is the nearest and substantially correct. Σ 1259 is identical with Weisse VIII. 937, and its place for 1830 from that Catalogue is:

R.A. = 8ʰ 35ᵐ 35ˢ Decl. = +39° 6′ 3″.

I did not find any star corresponding to the place in *Positiones Mediæ*—at least no star as bright as the 9th magnitude, while that star is rated by Struve as 7·5. Either the star is variable, or there is some error in the observation, probably the latter. Upon the first examination of this vicinity, I found a very pretty pair, which I then took to be Σ 1259, with a very considerable change both in angle and distance. For his pair Struve gives, P=4″·97; D=340°·9. The distance of the pair found was certainly not greater than 2″, and the angle obviously more than 340°. A mean of several measures, differing but slightly from each other, of the angle gave 355°·5. This star is Weisse VIII. 849, and the place for 1830:

R.A. = 8ʰ 35ᵐ 5ˢ Decl. = +39° 24′ 35″.

Finding that it differed from *all* the places given of Σ 1259, I made a further search, and at once found Struve's pair in the place given above. On the first occasion I examined all the stars that were prominent in the finder, but this escaped attention from its faintness. It is hardly possible that Struve should have overlooked the new pair, unless some change has occurred since his observations. It is nearly one magnitude brighter than Σ 1259; and as the components are about equal, it makes a very easy object, and one not likely to be overlooked with any aperture above 3 inches.

δ Cancri { R.A. = 8ʰ 35ᵐ 1ˢ; P.D. = 71° 13′ 39″ } *h* 457 makes position 160°, distance 25″. Lassell, *Astr. Nach.*, No. 858, states it as, position 121° 12′, distance 45″. What is it really?

The companion though rated by Herschel as 15 magnitude, was noted by me as "well seen with 400; the distance certainly more than 25″—probably not less than 45″. The angle appears to be nearer 120°, but too minute to estimate with great certainty." Subsequently I made three measures of the angle, the mean of which gave P=120°. The companion is very faint, but the separate results are sufficiently accordant (120°·5, 118°·5, 121°·5) to make it apparent that Herschel erred in his estimate of the angle. I made no attempt to measure the distance; but it is obviously greater than the value assigned by Herschel, and undoubtedly Lassell's result is also correct in that respect.

1874MNRAS..34..370B

h 2616 R.A. = 12h 29m; P.D. = 75° 17′. Close to a star of 9th mag. is a small, well-defined body, *which may be* a close double star. *n p* is a very faint nebula (no doubt III. 602, or Neb. No. 3113 of my *General Catalogue*). Is it there still? Was it a planet?

In Herschel's "Queries" the name or number of the star is erroneously printed *δ Cancri*. It should be as I have given it, *h* 2616. This is a faint double star, and readily seen with a 6-in. aperture when the conditions are favorable. It is strange that Herschel should have had any doubt about it, unless his instrument was not properly in focus at the time, or the definition was very poor, when a close, faint pair might present some such appearance as that described. I estimated the angle of this pair as about 310°, and distance perhaps a little more than 2″. Their 9th magnitude star near it is L 23620, given in Lalande as 8th magnitude (and by another observation 7) the place of which (1830) is:

R.A. = 12h 30m 2s P.D. = 75° 15′ 15″.

I measured the distance and angle of the faint pair from this star, obtaining P=237°; D=93″. The very faint nebula referred to, I did not notice.

κ Virginis R.A. = 14h 3m 50s; P.D. = 99° 28′ 42″. *σ* 453 (*Catalogi Prioris*). Is it really a double star?

It is not properly speaking a double star. There are two distant companions, one nearly following, the other preceding, both too far away to make it an object of any interest. No measures have ever been made, nor is it found in any catalogue where measures are given.

ω Boötis R.A. = 14h 54m 40s; P.D. = 64° 18′ 58″. *σ* 469. Is it really double?

There are some minute stars in the field, but they are too distant to be regarded as companions. Examined on a superb night; the star perfectly round, with 400. This is not included in any regular or original catalogue of double stars.

h 1271 R.A. = 15h 15m 18s; P.D. = 107° 59′ 48″.
h 4768 R.A. = 15h 15m 18s; P.D. = 109° 0′ 43″.
Are these identical? and, if so, which P.D. (differing 1°) is the right? The measures agree.

1874MNRAS..34..370B

In the P.D. of the latter (from *Cape Observations*) there is undoubtedly an error of 1°. The measures and magnitudes of the two pairs correspond very closely. I found *h* 1271 at once in the place assigned, but could find no double star at all in the neighbourhood of 1° further south.

$$h\,256\left\{\begin{array}{lrrr} & \text{h} & \text{m} & \text{s}\\ \text{R.A.}= & 15 & 32 & 2\\ & \circ & ' & ''\\ \text{P.D.}= & 71 & 40 & 0\end{array}\right\}$$

Not found subsequently; but ? if properly looked for. Does it exist? Measures 5° *sf*; distance 2″.

I have not been able to find any such pair in this place. I have also examined the catalogues to see if there is any which might have been observed and the degree of P.D., or hour of R.A. erroneously noted, but do not find any pair likely to be the one in question. Herschel has not given the magnitudes of this pair.

$$\Sigma\,2012\left\{\begin{array}{lrrr} & \text{h} & \text{m} & \text{s}\\ \text{R.A.}= & 16 & 0 & 49\\ & \circ & ' & ''\\ \text{P.D.}= & 97 & 48 & 13\end{array}\right\}$$

Is this really identical with B.A.C. 5379?

This is one of Struve's rejected stars, and of course given in the early catalogue without measures. This is not B.A.C. 5379, but is L 29435, which is 48^{s} *p* and 2′ 52″ *n*. My estimates of angle and distance were: P=270°; D=15″; mags. 8, 13. I have since found an observation of this pair in *Cape Observations*, where P=256°·7; D=20″± ; mags. 8½, 11. I know of no other measures. Herschel gives the place in that work for 1830:

$$\text{R.A.} = 16^{h}\ 0^{m}\ 49^{s} \qquad \text{P.D.} = 97^{\circ}\ 47'\ 27''$$

The place (substantially the same) from Lalande for the same epoch is:

$$\text{R.A.} = 16^{h}\ 0^{m}\ 50^{s} \qquad \text{P.D.} = 97^{\circ}\ 47'\ 54''$$

$$h\,584\left\{\begin{array}{lrcr} & \text{h} & \text{m} & \text{s}\\ \text{R.A.}= & 16 & \left\{\begin{array}{c}7\\13\end{array}\right\} & 58\\ & \circ & ' & ''\\ \text{P.D.}= & 50 & 20 & 45\end{array}\right\}$$

R.A. between 7^{m} and 13^{m}. ? the right minute.

The seconds of R.A. should be 48^{s} to correspond with the original observation in the second Catalogue of Herschel, and the R.A. is there stated to be between 16^{h} 7^{m} and 16^{h} 12^{m}. I find that the correct minute is 12. This is a faint and insignificant pair.

$$\left.\begin{array}{ll}\Sigma'\,(1814)\left\{\begin{array}{lrrr} & \text{h} & \text{m} & \text{s}\\ \text{R.A.}= & 16 & 16 & 48\\ & \circ & ' & ''\\ \text{P.D.}= & 88 & 23 & 2\end{array}\right. \\ \Sigma\,2041\left\{\begin{array}{lrrr} & \text{h} & \text{m} & \text{s}\\ \text{R.A.}= & 16 & 16 & 48\\ & \circ & ' & ''\\ \text{P.D.}= & 88 & 21 & 35\end{array}\right.\end{array}\right\}$$

"Loco 2041." Are these really two double stars? and, if so, to which does the description, position 4°·4, distance 3″·06, belong?

1874MNRAS..34..370B

The first number refers to *Positiones Mediæ*, and the place is from that Catalogue. The second place is the same as that in *Mensuræ Micrometricæ*. It is somewhat remarkable that the fact should have been, so far as I am aware, overlooked heretofore that OΣ 308 and Σ 2041 are really the same star. It is a very beautiful pair, and has been measured several times since its discovery. Struve (1831·4) gave P=4°·4; D=3″·06; mags. 7·3, 10·5. Mädler (1845·5), measuring it as OΣ308, found P=5°·6; D=2″·82, and Dembowski (1865·8) in his measures of the stars composing Otto Struve's Catalogue gives P=1°·9; D=2″·61; mags. 7·2, 9·8. From these results it would seem that the distance must have decreased, while the angle is unchanged. It is worthy of further attention. I have examined very carefully all the other stars in the vicinity, and find only this pair.

Otto Struve's place for 1850 is:

R.A. = 16h 14m 14s   P.D. = 88° 26′

I made no special observations for the purpose of identifying this star in the catalogues, beyond ascertaining it was about 12′ north of σ (50) *Serpentis*. There appears to be confusion in reference to the place. None of the stars in Lalande agree with the foregoing. The nearest are (1850):

		h	m	s		°	′	″
L 29860 (8½ mag.)	R.A. =	16	16	44	P.D. =	88	24	1
L 29868 (8 mag.)	R.A. =	16	16	58	P.D. =	88	29	31

I have just referred to Argelander's Catalogue and find a star which agrees with Otto Struve, and is undoubtedly the double in question. It is 11′·1 north of 50 *Serpentis* and 17s preceding. Its place for 1850 is:

Arg. (+1°) 3112   R.A. = 16h 14m 13s   P.D. = 88° 26′·2

Argelander gives the magnitude as 8·2, but it seemed to me rather brighter. It is not in Weisse or Lalande.

Mayer { R.A. = 17h 1m 29s; P.D. = 114° 2′ 43″ } Is there any double star in this place?

This is 39 *Ophiuchi* (=H III.25=H VI.54=Sh.245). The place does correspond exactly to that given above, but there is no other pair near this place.

Σ 2190 { R.A. = 17h 29m ±; P.D. = 68° 53′ } The measures of this star are very conflicting. Σ (1829) makes position 33°·22 *h* (1830), by a sweep 18°·4 (plainly written in original, and diagram agreeing) Mädler (1843) 33°·67, and Dembowski (1863) 23°·00. Which is right?

1874MNRAS..34..370B

I have not examined this sufficiently to account for the discrepancy positively; but it seems probable that Herschel and Dembowski measured, not Σ 2190, but *h* 2807, the R.A. of which is exactly the same, but the Decl. is 25′ less. Struve's measures of his pair are $P=33^{\circ}{\cdot}2$; $D=10''{\cdot}17$; mags. 6, 9·5. Herschel for *h* 2807 gives $P=22^{\circ}{\cdot}4$; $D=8''\pm$; mags. 7, 11. As will be seen, the two doubles are very similar in magnitudes and distance, with about the difference in angle indicated by the measures given above. I examined this vicinity once, and perhaps twice, and each time failed to see Herschel's pair, notwithstanding the conditions were at least moderately favourable. I am unable to account for the failure to find it, as it should be an easy object, if Herschel's magnitudes are correct. He describes it as "very fine."

H I. 60
R.A. = $18^{\mathrm{h}}\ 57^{\mathrm{m}}\ 0^{\mathrm{s}}$
P.D. = $58^{\circ}\ 32'\ 41''$
Query, as to its existence in this place, or very near it.

The name of this star is printed in the "Queries" H 4599, but that is evidently an error. It might have been written H *h* 599 as is No. 599 of Sir John Herschel's Catalogue of his father's double stars. The proper designation of the star is as given above. Herschel states in the catalogue last referred to, that this pair may possibly be Σ 2441 with an error of 5° in the angle. I have shown in a previous paper concerning Sir William Herschel's double stars (*Monthly Notices*, January 1874), that there is very little if any doubt that these two stars are identical. Herschel II. gave $P=286^{\circ}{\cdot}8$; Struve, $P=291^{\circ}{\cdot}9$. I have carefully examined all the stars in this vicinity, and fail to find any other of Class I; *h* 1366 has the same decl. but is about 3^{m} preceding. The distance ($10''{\cdot}\pm$) is too great for a double of the class described, and both components are too faint to render it of any special interest. In addition to that, the angle is entirely different ($57^{\circ}{\cdot}8$). I noticed an 8th magnitude star about $2\frac{1}{2}^{\mathrm{m}}$ *p.* this, with a very minute close double companion, but too faint to be worth cataloguing.

Σ 2545
R.A. = $\begin{cases} 19^{\mathrm{h}}\ 27^{\mathrm{m}}\ 32^{\mathrm{s}} \\ 19\ \ 29\ \ 33 \end{cases}$
P.D. = $100^{\circ}\ 31'\ 57''$
Smyth described this as "closely following" a star R.A. $19^{\mathrm{h}}\ 27^{\mathrm{m}}\ 28^{\mathrm{s}}$, and the R.A. $19^{\mathrm{h}}\ 27^{\mathrm{m}}\ 32^{\mathrm{s}}$ given by him differs 2^{m} from Σ. Which is right?

The larger of the two R.A's. is right, and is the place given in *Positiones Mediæ*. This is L 37207, giving exactly the same result. Σ 2541, Σ 2545 and Σ 2547 are in the same neighbourhood, and in some way it is probable Smyth's observations were confused. The identity of this pair with H I. 13, has been clearly shown by Dawes (*Memoirs of the R.A.S.* vol. xxxv), and other evidence bearing upon the same questions has been adduced by Hunt (*Monthly Notices*, January 1872).

1874MNRAS..34..370B

		h	m	s
Σ′ (2360)	R.A. =	19	40	4
		°	′	″
	P.D. =	57	31	25
		h	m	s
H *h* 640	R.A. =	19	39	54
		°	′	″
	P.D. =	57	19	48

Are these not identical; the P.D. applied to H *h* 640 being 11′ wrong?

I have previously called attention to the error in Sir John Herschel's place of this pair (=HN. 110.) This is identical with S. 726. The place is correctly given in *Positiones Mediæ*, as quoted above.

		h	m	s
Σ 2634	R.A. =	20	1	50
		°	′	″
	P.D. =	73	41	46

Smyth identifies his No. 733 (*Cycle*) with this star, and with H *h* 668; but his P.D. 73° 33′ 54″ (for 1830) differs 8′. Are these two double stars?

There is no other pair in or very near this place. This pair (=H II. 70=S. 734) is Weisse XX. 42, 43, corresponding exactly with *Positiones Mediæ*. Smyth's P.D. is erroneous.

		h	m	s
σ 680	R.A. =	20	22	53
		°	′	″
	P.D. =	79	23	3
		h	m	s
Σ 2690	R.A. =	20	23	6
		°	′	″
	P.D. =	79	18	22

Are not the same double stars? Σ 2690 is identified with Dawes (1); *h* (269); H *h* 691; and OΣ 407.

I cannot find any other double star in or near this. This pair is very much confused in the early catalogues. The corresponding numbers are:—H III. 16=Sh. 325=S. 751=σ 681 =OΣ 407=Dawes 1. It is given with measures of the wide pair in South, and Herschel's Catalogue, and again in South's with a different designation, and obviously regarded as a different star. Sir John Herschel included it in his First Catalogue, giving the magnitudes as 9=9, stating "possibly σ 680, but disagreeing much in R.A. and P.D." In a later work he says it is identical with Σ 2690. There are two pairs, in Struve's First Catalogue, σ 680 and σ 681, having the same R.A. with a difference of 10′ in decl. The magnitude of the first is given 8, and that agrees in place with L 39521, and is undoubtedly that star. The second (681) is called H III. 16, and the magnitude and decl. correspond with that pair. There is no companion to L 39521—at least near enough to constitute a double star. H III. 16 is erroneously stated by Otto Struve to be *h* 1521.

		h	m	s
h 2994	R.A. =	20	36	18
		°	′	″
	P.D. =	112	7	33

17 *Capricorni*. "Requires verification." Position 338°·7; distance 20″±. A *very* minute companion.

1874MNRAS..34..370B

I have examined this star several times when the conditions were sufficiently favorable to show the companion to α^2 *Capricorni* steadily, and I have never been able to see the least trace of the suspected companion. Herschel entered the magnitude as 20; but I have seen many of his minute companions theoretically far beyond the reach of a 6-inch aperture. I am certain this star, if it exist at all, is not within the grasp of my instrument under any circumstances.

		h	m	s	
h 1619 *h* 1620	R.A. =	21	4	22	Are not these the same, but 1° P.D. mistaken in one or the other? Which is right? *h* 1620 is described as quadruple.
		°	′	″	
	P.D. =	76 77	9 9	37 36	

I examined both places, and failed to find a double in one of them; but from some confusion in the notes, I am unable to state positively in what star the error occurs.

		h	m	s	
h 5517	R.A. =	21	14	54	18 *Aquarii.* Query, a very minute companion at 13″ distance.
		°	′	″	
	P.D. =	103	36	6	

I have never seen the companion, though carefully looked for on several first-class nights. I have found in this general quarter of the heavens a good many new doubles, some of them as difficult as any double stars I have ever seen, and when these were well seen, no companion could be even suspected to 18 *Aquarii.*

		h	m	s	
Σ 2792	R.A. =	21	15	42	Query, If not the same, with 1° error in P.D. in one or the other; and if so, which is right?
		°	′	″	
	P.D. =	61	46	6	
		h	m	s	
h 1638	R.A. =	21	15	43	
		°	′	″	
	P.D. =	62	46	43	

There is an error in Herschel's P.D. beyond doubt. A careful examination of this region leaves but little uncertainty. On this occasion I found a second minute companion to Σ 2792, not noticed by Struve. The distance is rather more than double Struve's star, or about 20″, and the angle nearly 180°.

		h	m	s	
Σ 2827	R.A. =	21	38	54	The latter star seems to be only the former with its place better determined. Σ 2827 is a really existing double star = *h* 1690 = Σ 2827 of the *Mens. Mic.* Are these really two double stars very near each other? *h* 1690's place is $21^h\ 39^m\ 32^s$, 27° 11′ 1″.
		°	′	″	
	P.D. =	27	9	54	
		h	m	s	
Σ (2628) " Loco Σ 2827 "	R.A. =	21	39	5	
		°	′	″	
	P.D. =	27	8	39	

1874MNRAS..34..370B

In the "Query" the P.D. of each star is erroneously printed 28°. It should be 27°. I do not find but the one pair in this place. Herschel's place agrees with *Mensuræ Micrometricæ.* I did not observe this pair sufficiently to identify it in the catalogues.

$$h\ 1761 \left\{ \begin{array}{l} \text{R.A.} = 22^{h}\ 16^{m}\ 24^{s} \\ \text{P.D.} = 16^{\circ}\ 0'\ 38'' \end{array} \right\}$$ Oblong. Requires re-examination.

Herschel gives P = 40° ± ; D = $1''\frac{1}{2}$ ± ; mags. 12 = 12. I have looked very carefully for this, and in so doing found a new pair (No. 175 of my Third Catalogue, *Monthly Notices*, December 1873), which at first I thought might be Herschel's, but that is not probable, as there is a difference of 12^{m} in R.A. and 9′ in Decl. between the two. Of the new pair I estimated, P = 120° ; D = $1''\cdot5$; mags. $9\frac{1}{2}$, $9\frac{1}{2}$. It is an exceedingly difficult object, and could only be well seen under very favourable conditions. This was observed several times, and Herschel's pair also looked for, but without success.

$$h\ 5529 \left\{ \begin{array}{l} \text{R.A.} = 22^{h}\ 28^{m}\ 57^{s} \\ \text{P.D.} = 95^{\circ}\ 6'\ 4'' \end{array} \right\}$$ *κ Aquarii.* An excessively minute companion strongly suspected.

This star, like 17 *Capricorni* and 13 *Aquarii* has defied all efforts to detect the companion.

$$h\ 3158 \left\{ \begin{array}{l} \text{R.A.} = 22^{h}\ 53^{m}\ 15^{s} \\ \text{P.D.} = 20^{\circ}\ 8'\ 37'' \end{array} \right\}$$ Excessively close. Requires verification. Position 45°.

Carefully examined on a good night, but without success. If there is any double here, which I very much doubt, it must be one of extraordinary difficulty.

$$\left. \begin{array}{l} \text{Sh. } 358 \left\{ \begin{array}{l} \text{R.A.} = 23^{h}\ 46^{m}\ 20^{s} \\ \text{P.D.} = 59^{\circ}\ 6'\ 20' \end{array} \right. \\ \sigma\ 790 \left\{ \begin{array}{l} \text{R.A.} = 23^{h}\ 49^{m}\ 22^{s} \\ \text{P.D.} = 59^{\circ}\ 11'\ 40'' \end{array} \right. \end{array} \right\}$$? If two distinct double stars. If only one, ? its place.

The second star is called by Herschel σ 690 ; it should be as given here, σ 790. There is only one pair in this place, and that is Sh. 358 : P = $329^{\circ}\cdot2$; D = $41''\cdot29$. It is a very uninteresting pair, the stars small and widely separated. This is L 46844-5, from which its place (1830) is:

R.A. = $23^{h}\ 45^{m}\ 43^{s}$ P.D. = 59° 2′ 37″.

Chicago, 1874, *April* 24.